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Original Article

FERTILIZER USE EFFICIENCY AND ECONOMIC ASSESSMENTS OF RED CHILLI (CAPSICUM ANNUUM L.) WITH FERTIGATION CUM MULCHING

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ABSTRACT

A field study was conducted to evaluate the Fertilizer use efficiency (FUE) and economic assessment of red chili. in responses to different fertilizers sources with mulching. The experiment was laid out in Randomized complete Block design with three replications and nine treatments combinations involving fertigation and mulching. The results revealed that significantly higher FUE (13.10 kg^{-}NPK^{-1}) and yield (5.03 t ha$^{-1)}$ were observed by the treatment viz., application of water- soluble fertilizers 100 per cent recommended dose of fertilizers (RDF) with mulching, followed by normal fertilizers 100 per cent RDF through fertigation with mulching than non-mulched and conventional fertilizer application. The higher net returns (Rs. 6, 09,651 ha^{-1}) and B: C ratio (3.11) was recorded in the treatment of normal fertilizers 100 per cent RDF through fertigation with mulching than other treatments. From this investigation, it is concluded that water- soluble fertilizers as well as normal fertilizers fertigation with mulching ideal for maximum FUE, yield, and economics of the chili crop.

KEYWORDS: Chili, Fertigation, Mulching, Fertilizer Use Efficiency & Net Returns

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INTRODUCTION

Chili is botanically called as *Capsicum annuum*L., belonging to the nightshade (Solanaceae) family. It is the second largest commodity after black pepper (*Piper nigrum*L.) in the international spice trade and it is considered to be a universal spice of India. It was first introduced into India by the Portuguese traders towards the end of the 15th century and its cultivation became popular in the 17th century. Though chili is an introduced crop in India, it is grown throughout the country in almost all the states with a production of12.23 lakh tons from 7.92 lakh hectare area which accounts around 22.90 per cent of the total Indian spice production (Anon., 2017). Chilies are used in both green and dry form in all culinary preparations, equally by rich and poor alike. Chili fruits are a rich source of several vitamins like vitamin C (ascorbic acid), pro-vitamin A, E, P (citrin), thiamine (B_1), riboflavin (B_2) and niacin (B_3), and minerals like molybdenum, manganese, iron, potassium and copper.

Balanced nutrition is one of the most important factors affecting the growth and productivity of chili. Micro-irrigation and fertigation are the only to replace the conventional method to achieve fertilizer use efficiency and higher economics (Manohar, 2002). Mulching is an important practice for crop production, it has been concluded that the practice of mulching reduces the erosion of soil by way of preventing the runoff and soil loss,

minimize the weed infestation, and checks the evaporation of water, thus facilitates for more retention of soil moisture, chemical and biological properties of soil as it adds nutrients to soil and ultimately enhances the growth and yield of crops and profits. (Biawas*et al.* 2015). Cost of water-soluble fertilizers like potassium nitrate (KNO_3), monopotassium phosphate, calcium nitrate and sulphate of potash were very high compared to conventional fertilizers like urea, diammonium phosphate, muriate of potash. As the purchasing power of the farmer is very low, hence, the present study was conducted to analyze the Effect of water soluble and conventional fertilizers on fertilizer use efficiency and economic assessment in red chili.

MATERIELS AND METHODS

A field study was conducted at the Division of the vegetable crop, Indian Institute of Horticulture Research, Bangalore, Karnataka (India) during 2016-17. The soil was red loamy with, pH of 5.5, medium inorganic carbon (0.49 per cent), medium in nitrogen (303.18 kg ha^{-1}), high in phosphorus (41.44 kg ha^{-1}), high in available potassium (366.51 kg h^{-1}) and normal in EC (0. 42 ds m^{-1}). Chili (Hybrid cv. Arka Meghana) was taken as test crop during the study. The experiment was laid out in a Randomized block design with three replications. The treatment details are

T_1: Fertigation with water-soluble fertilizers (Urea, 19:19:19 and KNO_3) @ 100% RDF and polyethylene mulching

T_2: Fertigation with water-soluble fertilizers (Urea, 19:19:19 and KNO_3) @ 75% RDF and polyethylene mulching

T_3: Fertigation with water-soluble fertilizers (Urea, 19:19:19 and KNO_3) @ 100% RDF and without mulching

T_4: Fertigation with water-soluble fertilizers (Urea, 19:19:19 and KNO_3) @ 75% RDF and without mulching

T_5: Fertigation with normal fertilizers (Urea, DAP and MOP) @ 100% RDF and polyethylene mulching

T_6: Fertigation with normal fertilizers (Urea, DAP and MOP) @100% RDF and without mulching

T_7: N&K fertigation with water-soluble fertilizers (Urea and KNO_3), soil application of P fertilizer (Single Super Phosphate) @100% RDF and polyethylene mulching

T_8: N&K fertigation with water-soluble fertilizers (Urea and KNO_3), soil application of P fertilizer (Single Super Phosphate) @100% RDF and without mulching

T_9: Control – Drip irrigation, non-mulched and soil application of NPK fertilizers (Urea, SSP and MOP) @ 100% RDF

Planting spacing was maintained as per recommended spacing of 60 cm x 45 cm. The recommended dose of NPK (180:120:180 kg/ha) fertilizers applied as per the treatments imposed. Fertigation was done at weekly intervals starting from 21 DAP up to 150 DAP. All other cultural practices were done as per standard recommendation for chili.

The total fruits harvested in each picking of the treatment were computed and expressed as the weight of fruit in kg per bed and converted as t ha^{-1} (dry fruits). The fertilizer use efficiency was worked out separately for N, P and K by dividing the total yield (q/ha) with total fertilizer applied (kg/ha). (Veeranna et al., 2000). The prices of all the inputs and the labor cost that were prevailing at the time of their use were considered to work out the Cost cultivation. The gross income was worked out based on the prevailing market price when the produce was ready to market. Net income per hectare was calculated on the basis of gross income and cost of cultivation per hectare**.** The benefit-cost ratio was worked

out by using the following formula.

$$\text{Benefit: Cost ratio} = \frac{\text{Net income (Rs. ha}^{-1})}{\text{Cost of cultivation (Rs. ha}^{-1})}$$

RESULTS

Fertilizer Use Efficiency

Data on Table1. Indicated that application of WSF fertigation (100% RDF) with mulching recorded significantly higher fertilizer use efficiency of (13.10kg kg-NPK-1) over the other treatments followed by NF fertigation (100% RDF) with mulching (11.87 kg kg-NPK-1). Whereas lower fertilizer use efficiency was recorded in soil application of fertilizers without mulching (6.68 kg kg-NPK-1).

Table 1: Effect of Fertigation and Mulching on Fertilizer use Efficiency of Red Chili

Treatments	Yield Kg/Ha	Applied NPK Kg/Ha	FUE Kg Yield/Kg NPK
T_1	5033.24	480	13.10
T_2	4717.95	360	10.48
T_3	4463.63	480	9.30
T_4	4272.44	360	10.06
T_5	4831.91	480	11.87
T_6	4232.91	480	8.82
T_7	4801.14	480	10.02
T_8	4217.95	480	8.79
T_9	3293.52	480	6.86
S. Em	0.11	480	0.57
C. D at 5%	0.32		1.7

Economics

Table 2. showed that among the treatment combinations normal fertilizers (100% RDF) applied through fertigation with mulching recorded maximum gross revenue (Rs 6,29,200), net profit (6,096,541)and a cost-benefit ratio (3.11), while least is the combination of 100 percent RDF of normal fertilizers through soil applications without mulching (gross revenue Rs 4,29,000), net profit (Rs 2,62,849) cost-benefit ratio 1:58 respectively. High fertilizer dose through fertigation with and without mulching increased significantly higher production of chili over the soil application.

Table 2: Effect of Fertigation and Mulching on Cost Economics (Per Hectare) of Red Chili

Treatments	Total Yield T Ha^{-1}	Total Cost Of Cultivation (R. S)	Gross Returns	Net Returns	B:C Ratio
T_1	5.03	250384	653900	403516	1:62
T_2	4.72	233471	613600	380129	1:63
T_3	4.46	221044	579800	358756	1:62
T_4	4.28	204131	556400	352269	1:72
T_5	4.84	195491	629200	609651	3:11
T_6	4.23	166151	549900	383749	2:30
T_7	4.81	222181	625300	403119	1:8
T_8	4.22	192841	548600	355759	1:75
T_9	3.30	166151	429000	262849	1:58

DISCUSSIONS

Higher fertilizer use efficiency in terms of yield chili per unit of applied nutrients was observed in fertigation with mulching treatments may be the effective uptake of nutrients by the plants, higher soil moisture availability, control of weed growth in a drip fertigation system with mulching than of soil application. Similar results were made by Shyama*et al.* (2009) and Ramachndrappaet al. (2010), Kumara et al.(2016) in chili.

While higher B: C ratio was recorded in normal fertilizers compare to water-soluble fertilizers, the probable reason for getting more benefit-cost ratio may be due to the lesser cost as compare to water-soluble fertilizers and no problem in clogging and other blockages of drip system with little care of application. These findings are in agreement with the findings of Muralikrishnasamy et al (2006), Selvakumar (2006), Sanchita et al, (2010) in chili and Prabhakar et al. (2010) in tomato and cauliflower by Ilakiyanila (2012). Similar results were reported in chilies by Pandey et al. (2013) and Biswas et al. (2015).

CONCLUSIONS

From the present investigation, it can be concluded that fertigation with water-soluble and normal fertilizers produced on par results. Overall fertigation and mulching produced higher FUE and higher net returns compared to soil application and non-mulching.

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